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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicant	:	Usami et al.	)
Appl. No.	:	10/005,880	)
Filed	:	November 2, 2001	)
For	:	**COPPER ALLOY MATERIAL FOR PARTS OF ELECTRONIC AND ELECTRIC MACHINERY AND TOOLS**	)
Examiner	:	Unknown	)

PETITION TO MAKE SPECIAL FOR NEW APPLICATION UNDER 37 C.F.R. § 1.102 AND M.P.E.P. §708.02 [VIII]

United States Patent and Trademark Office
PO Box 2327
Arlington, VA 22202

Dear Sir:

Under the provisions of 37 C.F.R. § 1.102 and M.P.E.P. §708.02 [VIII], Applicants hereby petition to make special the above-identified application in order to advance its examination in the Patent and Trademark Office. The application was previously filed on November 2, 2001, as U.S. Application No. 10/005,880.

A check for the payment of the fee of $130 under 37 C.F.R. 1.17(h) is enclosed. Please charge any additional fees or credit overpayment to Deposit Account No. 11-1410.

Should a restriction requirement be necessary, Applicants request that prompt telephonic notice be given to Applicants' counsel, at which time Applicants will make an election without traverse.

A pre-examination search was conducted in the following areas:

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Class C22: Metallurgy; Ferrous or non-ferrous alloys; Treatment of alloys or non-ferrous metals

Subclasses C22C: Alloys

C22F: Changing the physical structure of non-ferrous metals or non-ferrous alloys

Applicants submit with this petition a copy of each reference not already of record deemed most closely related to the subject matter encompassed by the claims, including all references located during the search

The application contains four independent claims, numbered 1, 2, 3, and 9. The discussion below focuses first on the language of Claims 1 and 2 and the distinctions between these claims and the most relevant prior art. Next, Claims 3-14 are similarly discussed. Finally, each reference discovered in the search is briefly described.

DISCUSSION OF THE CLAIMS

Claims 1 and 2

Claims 1 and 2 are directed to Cu alloys containing several other alloying elements including Ni and Si. The claims further restrict some properties of the grains of the metal alloy. Both Claims 1 and 2 require that the ratio (a/b), between a longer diameter a of a crystal grain on a cross section parallel to a direction of final plastic working, and a longer diameter b of a crystal grain on a cross section perpendicular to the direction of final plastic working, is 1.5 or less. No prior art reference uncovered during the search teaches this grain shape in a Cu-Ni-Si alloy. Applicants believe that the references which most closely relate to these claims are: U.S. Patent No. 4,877,577 to Futatsuka et al.; U.S. Patent No. 5,463,247 to Futatsuka et al.; Japanese Patent JP 11-222641; and Japanese Patent JP 11-043731. However, none of these references disclose an alloy having a grain shape with a ratio of 1.5 or less.

As described in the specification at page 17 of the present invention, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28

of Table 3 of the present invention, show the effects of a crystal grain shape being greater than 1.5. When the ratio (a/b) exceeds 1.5, the stress relaxation decreases. The elongation percentage and bending properties tend to be adversely effected by an excessive grain ratio, as well. None of the above-mentioned references teach an alloy having a grain ratio of 1.5 or less.

Accordingly, as these closely related references do not teach a grain ratio of 1.5 or less, Claims 1 and 2 are patentable for at least these reasons. These references, as well as the other references, will be described in further detail hereinbelow.

Claims 3-14

Independent claims 3 and 9 require a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm. Applicants believe the most closely related references are U.S. Patent No. 4,877,577 to Futatsuka et al.; U.S. Patent No. 5,463,247 to Futatsuka et al.; Japanese Patent JP 11-222641; and Japanese Patent JP 11-043731, and Japanese Patent JP 11-256256. Of these references, the first four do not teach any surface roughness characteristic. Although JP '256 mentions desirable surface roughness, it does not teach the alloying elements as required by Claims 3-14. JP '256 presents no working examples having the elements as recited in these claims. In this regard, the applicant specifically notes that the majority of the examples provided in JP '256 do not contain Sn. The examples that do contain Sn within the ranges as claimed in the present invention contain an excess of Mg. Comparative example 54 of the present invention shows the effects of an excess of Mg, which produces poor bending properties.

Accordingly, independent Claims 3 and 9 are patentable over JP '256. As Claims 4-8 and 10-14 are dependent on Claims 3 and 9, respectively, they are patentable for at least the same reasons.

DISCUSSION OF THE REFERENCES

Applicants provide the following discussion of the references, which points out with the particularity required by 37 C.F.R. § 1.111(b) and (c) how the claimed subject matter is distinguished over the references.

U.S. Patent No. 4,362,579 to Tsuji ("Tsuji")

The Tsuji patent teaches a copper alloy comprising 10-35 wt% Zn, which is well outside the range of the Zn content as required by Claims 1-14. Sample 10 of Table 2 of the present application shows the effects of excess Zn. The bending properties were shown to be insufficient.

Furthermore, Tsuji does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present invention, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

Tsuji also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, the Tsuji patent does not teach or suggest the copper alloy of the present application.

U.S. Patent No. 4,877,577 to Futatsuka et al. ("Futatsuka '577")

Futatsuka '577 does not disclose the claimed a/b ratio of 1.5 or less or the grain diameter being 0.001mm - 0.025mm, as required by Claims 1-2 of the present invention. As described in the specification at page 17 of the present application, the grain size diameter effects both the bending and stress relaxation properties, and the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5, while samples 33, 34, 36, and 38 show the effects of a crystal grain diameter being either too small or too large.

Futatsuka '577 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Since Futatsuka '577 does not teach or suggest an alloy having a crystal grain diameter between 0.001mm and 0.025mm and a grain ratio of 1.5 or less or a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, the present invention is patentable over Futatsuka '577.

<u>U.S. Patent No. 5,028,391 to Ingerson ("Ingerson")</u>

Ingerson teaches a copper-nickel-silicon-chromium alloy having 9.5-11. wt% Ni and, a Ni-Si ratio of 3.4 to 4.5. A Ni-Si ratio of 3.4 to 4.5 corresponds to a wt% Si of about 2.11-3.24. The Ni and Si values exceed those as claimed in the present invention significantly.

Furthermore, Ingerson does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

Ingerson also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, Ingerson does not teach the copper alloy as claimed in the present application.

<u>U.S. Patent No. 5,334,346 to Kim et al. ("Kim")</u>

Kim does not teach including Sn in a copper alloy, as required by the Claims 1-14.

Furthermore, Kim does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

Kim also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large.

Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, the present invention is patentable over Kim.

U.S. Patent No. 5,463,247 to Futatsuka et al. ("Futatsuka '247")

Futatsuka '247 does not disclose the claimed a/b ratio of 1.5 or less or the grain diameter being 0.001mm - 0.025mm, as required by Claims 1-2 of the present application. As described in the specification at page 17 of the present application, the grain size diameter effects both the bending and stress relaxation properties, and the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5, while samples 33, 34, 36, and 38 show the effects of a crystal grain diameter being either too small or too large.

Futatsuka '247 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Since Futatsuka '247 does not teach or suggest an alloy having a crystal grain diameter between 0.001mm and 0.025mm and a grain ratio of 1.5 or less or a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, the present invention is patentable over Futatsuka '247.

Japanese Patent JP 11-222641

JP '641 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

JP '641 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large.

Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Since JP '641 does not teach a crystal grain shape ratio of 1.5 of less or a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, the present application is patentable over JP '641.

<u>Japanese Patent JP 11-256256</u>

JP '256 presents no working examples having the elements as required by Claims 1-14. A majority of the examples provided in JP '256 do not contain Sn. The examples that do contain Sn within the ranges as claimed in the present invention, contain an excess of Mg. Comparative example 54 of the present invention shows the poor bending properties associated with an excess of Mg.

Furthermore, JP '256 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present invention, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present invention, show the effects of a crystal grain shape being greater than 1.5.

Accordingly, JP '256 does not teach the alloy as claimed in the present application

<u>Japanese Patent JP 05-059468</u>

JP '468 provides no working examples of an alloy as claimed in the present invention. Only examples 14 and 20 of JP '468 include all of the claimed elements. However, example 14 exceeds the presently claimed ranges in Ni, Si, and Zn, and lacks the required amount of Mg. Example 20 includes an excess of Mg and Sn. These alloys were shown to be inadequate in the comparative examples of the present invention. See Tables 4 and 5, in particular examples 52-56, and 61-63.

Furthermore, JP '468 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

JP '468 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, JP '468 does not teach the alloy as claimed in the present application.

Japanese Patent JP 01-180932

Although the claimed ranges overlap for the alloying elements, JP '932 shows no working examples which fall within the claimed ranges. All of the examples provided in JP '932 have insufficient Mg, and excess Ni. Comparative examples 52 and 53 show the effects of insufficient Mg, while comparative examples 61 and 63 show the effects of excess Ni. See Tables 4 and 5 of the present application. Insufficient Mg results in poor stress relaxation properties, while excess Ni results in poor bending properties.

Furthermore, JP '932 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

JP '932 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, the present invention is patentable over JP '932.

Japanese Patent JP 06-100983

The alloy of JP '983 is not directed to a Cu-Ni-Si-Mg-Zn alloy as claimed in the present invention. JP '983 does not teach an alloy having Ni, Si, Mg, and Zn. The alloy of JP '983 is directed to a copper alloy including Fe, Cr, Ti, Al, Mo, and Mn. JP '983 includes examples

which include Ni, Si, Mg, or Zn. However, none of the examples include all of the alloying elements as required by Claims 1-14 having the ranges as claimed.

Furthermore, JP '983 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

JP '983 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present invention. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, JP '983 does not teach the copper alloy as claimed in the present application.

Japanese Patent JP 61-127842

JP '842 provides no working examples which satisfy the elemental ranges as claimed in the present application. Furthermore, in Comparative Examples 152 and 153 of the present invention, alloys having less than the required Mg had a stress relaxation property, S.R.R, which was extremely elevated. The S.R.R. values were 29 and 26% respectively, compared to a range of 13-20% for examples of the presently claimed invention.

Furthermore, JP '842 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

JP '842 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Accordingly, JP '842 does not teach the alloy as claimed in the present application.

Japanese Patent JP 11-043731

JP '731 does not teach a crystal grain shape ratio of 1.5 or less. As described in the specification at page 17 of the present application, the shape of the crystal grain effects the stress relaxation property. Specifically, samples 31, 32, 35, 37, and 28 of Table 3 of the present application, show the effects of a crystal grain shape being greater than 1.5.

JP '731 also does not teach a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, as required by Claims 3-14 of the present application. As described in the specification at pages 19-22, repulsion and peeling occur when the surface roughness is too large. Specifically, samples 164, 165 of Table 5 of the present application show the effects of the surface roughness being too large.

Since JP '731 does not teach a crystal grain shape ratio of 1.5 of less or a surface roughness R_a between 0 and 0.1 μm or R_{max} between 0 and 2.0 μm, the present application is patentable over JP '731.

CONCLUSION

In view of the foregoing discussion, Applicants respectfully submit that the present invention is patentable over all of the references discussed above. More specifically, the references do not anticipate or render obvious the systems or methods of the present invention comprising, in one form thereof, a copper alloy material for parts of electronic and electric machinery and tools, comprising 1.0 to 3.0% by mass of Ni, 0.2 to 0.7% by mass of Si, 0.01 to 0.2% by mass of Mg, 0.05 to 1.5% by mass of Sn, 0.2 to 1.5% by mass of Zn, and less than 0.005% by mass of S, with a balance of Cu and inevitable impurities, wherein a crystal grain diameter is more than 0.001mm and 0.025mm or less; and the ratio (a/b), between a longer diameter a of a crystal grain on a cross section parallel to a direction of final plastic working, and a longer diameter b of a crystal grain on a cross section perpendicular to the direction of final plastic working, is 1.5 or less.

Ni and Si serve as bases of the alloy of the present invention serving to maintain mechanical characteristics without deteriorating heat and electrical conductivity. Mg improves stress relaxation characteristics. In addition, these characteristics can by remarkably improved,

by adding Sn and Zn in combination with Mg. The stress relaxation characteristics are particularly crucial for use as, for example, connectors. In this connection, Sn greatly improves the stress relaxation characteristics by adding it in combination with Mg. Zn improves the bending properties deteriorated by adding Mg. Although Sn and Zn are elements that adversely affect electrical conductivity, and they are naturally considered to be avoided from adding to this kind of copper alloy in the conventional art, well-balanced and excellent characteristics for use as connectors and the like can be manifested by purposely adding these alloying elements of Sn and Zn in the claimed alloy.

It has also been found in the present invention that the bending property and stress relaxation characteristics are improved or maintained at an excellent level, by controlling the crystal grain size as well as the shape of the crystal grains (the ratio (a/b) as defined in Claim 1: the ratio between the longer diameter (a) of a crystal grain on a cross section parallel to a direction of final-plastic working, and a longer diameter (b) of a crystal grain on a cross section perpendicular to the direction of the final-plastic working.

The invention as claimed allows alloy characteristics for use in connectors to be remarkably improved, while also contributing in making parts of electronic and electric machinery and tools, such as terminals, connectors, switches and relays to be a small size and having high performance, thereby exhibiting industrially remarkable, excellent effects.

Further, the alloy as claimed has enjoyed significant commercial success. PMX Industries of the United States, and Kemper of Germany have expressed strong interest in a licensing agreement with the Furukawa Electric Co. for use of the claimed alloy.

In view of this these arguments, the Applicants respectfully request expedited allowance of the claims.

Appl. No. : **10/005,880**
Filed : **November 2, 2001**

Applicants further respectfully submit that the requirements set forth under M.P.E.P. § 708.02 [VIII] for accelerated examination of the above-identified application have been satisfied. Therefore, Applicants respectfully request that this petition be granted.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 3/7/02

By: [signature]

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